XRF PERFORMANCE CHARACTERISTICS SHEET
TN Technologies (TN Spectrace); Pb Analyzer

EFFECTIVE DATE: October 31, 1995   **EDITION NO.**: 1

MANUFACTURER AND MODEL:

Manufacturer:	*TN Technologies, Inc. (TN Spectrace)*
Make:	*Pb Analyzer*
Model:	*9292*
Source:	Cd^{109}
Note:	This sheet supersedes all previous sheets for the XRF instrument of the make, model, and source shown above.

EVALUATION DATA SOURCE AND DATE:

This sheet is supplemental information to be used in conjunction with Chapter 7 of the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* ("HUD Guidelines"). Performance parameters shown on this sheet are calculated from evaluation data collected during the EPA/HUD field evaluation study conducted from March through October 1993 and from data collected during testing on the EPA/HUD archived building components in January 1995 and in September 1995. The field evaluation data were collected from approximately 1,200 test locations using two instruments both with radiation sources installed in April 1993. The results of this study are reported in *A Field Test of Lead-Based Paint Testing Technologies: Technical Report*, EPA 747-R-95-002b, May 1995. The archive testing data were collected from approximately 150 test locations using two instruments. The instrument that was used in January had a radiation source installed in July 1994 and the instrument that was used in September 1995 had a radiation source installed in January 1995. All of the aforementioned instruments had 30 mCi initial strengths.

FIELD OPERATION GUIDANCE

OPERATING PARAMETERS:

Performance parameters shown in this sheet are applicable only when operating the instrument under the same conditions as the evaluation testing and using the procedures described in Chapter 7 of the HUD Guidelines. Operating parameters include:

- Manufacturer-recommended warm-up and quality control procedures

- Use the Multifamily Decision Flowchart for determining the presence of lead on a component type in multifamily housing

- Nominal 15-second readings on three locations per component for single-family housing and one location per component for multifamily housing

- Calibration checks are taken using the red (1.02 mg/cm^2) NIST Standard Reference Material (SRM No. 2579) paint film

- Lead-based paint is defined as paint with lead equal to or in excess of 1.0 mg/cm^2.

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XRF CALIBRATION CHECK:

Chapter 7 of the HUD Guidelines recommends using a calibration check procedure to determine the operating condition of the XRF instrument. If the observed calibration check average minus 1.02 mg/cm^2 is greater than the positive (plus) calibration check tolerance value, or less than the negative (minus) calibration check tolerance value, then the instructions provided by the manufacturer should be followed in order to bring the instrument back into control before any more XRF testing is done. This calibration check is estimated to produce an incorrect result (that is, a finding that the instrument is out of calibration) very infrequently - once out of every 200 times this procedure is followed.

minus value = -0.3 mg/cm^2
plus value = +0.4 mg/cm^2

FOR XRF RESULTS BELOW 4.0 mg/cm^2, SUBSTRATE CORRECTION RECOMMENDED FOR:

None

SUBSTRATE CORRECTION <u>NOT</u> RECOMMENDED FOR:

Brick, Concrete, Drywall, Metal, Plaster, and Wood

INCONCLUSIVE RANGE OR THRESHOLD:

XRF results are classified using either the threshold or the inconclusive range. In single-family housing, an XRF result is the average of three readings taken on a testing combination. (A testing combination is a location on a painted surface as defined in Chapter 7 of the HUD Guidelines). In multifamily housing, an XRF result is a single reading taken on a testing combination. For computing the XRF result, use all digits that are reported by the instrument. For the threshold, results are classified as positive if they are greater than or equal to the threshold, and negative if they are less than the threshold. There is no inconclusive classification when using the threshold. For the inconclusive range, results are classified as positive if they are greater than or equal to the upper limit of the inconclusive range, and negative if they are less than or equal to the lower limit of the inconclusive range. Thresholds and inconclusive ranges were determined for comparing results to the 1.0 mg/cm^2 standard. For a listing of laboratories recommended by the EPA National Lead Laboratory Accreditation Program (NLLAP) for the analysis of samples to resolve an inconclusive XRF result or additional confirmational analysis, call the National Lead Information Center Clearinghouse on 1-800-424-LEAD.

DESCRIPTION	SUBSTRATE	INCONCLUSIVE RANGE in mg/cm^2	
		LOWER BOUND	UPPER BOUND
Results not corrected for substrate bias	Brick	0.9	1.2
	Concrete	0.9	1.2
	Drywall	0.9	1.2
	Metal	0.9	1.2
	Plaster	0.9	1.1
	Wood	0.9	1.3

INSTRUCTIONS FOR EVALUATING XRF TESTING:

Chapter 7 of the HUD Guidelines for recommends several options for evaluating XRF testing. Among those

options is the following procedure which may be used after XRF testing has been completed. In single-family housing, an XRF result is the average of three readings taken on a testing combination. (A testing combination is a location on a painted surface as defined in Chapter 7 of the HUD Guidelines). In multifamily housing, an XRF result is a single reading taken on a testing combination. If a multifamily housing development is being retested, randomly select two units from within the development from which the ten testing combinations should be randomly selected.

Randomly select ten testing combinations for retesting from each house or from the two selected units.

Conduct XRF retesting at the ten testing combinations selected for retesting.

Determine if the XRF testing in the units or house passed or failed the test by applying the steps below.

Compute the Retest Tolerance Limit by the following steps:

Determine XRF results for the original and retest XRF readings. Do not correct the original or retest results for substrate bias. In single-family housing a result is defined as the average of three readings. In multifamily housing, a result is a single reading. Therefore, there will be ten original and ten retest XRF results for each house or for the two selected units.

Compute the square of each of the ten original and ten retest XRF results.

Add these squares of XRF results together. Call this quantity C.

Multiply the number C by 0.0072. Call this quantity D.

Add the number 0.032 to D. Call this quantity E.

Take the square root of E. Call this quantity F.

Multiply F by 1.645. The result is the Retest Tolerance Limit.

Compute the overall average of all ten original XRF results over all ten testing combinations selected for retesting.

Compute the overall average of all ten retest XRF results over all ten testing combinations selected for retesting.

Take the difference of the overall average of the ten original XRF results and the overall average of the ten retest XRF results. If the difference is negative, drop the negative sign.

If the difference of the overall averages is less than the Retest Tolerance Limit, the inspection has passed the retest. If the difference of the overall averages equals or exceeds the Retest Tolerance Limit, this procedure should be repeated with ten new testing combinations. If the difference of the
overall averages is equal to or greater than the Retest Tolerance Limit a second time, then the inspection should be considered deficient.

Use of this procedure is estimated to produce a spurious result approximately 1% of the time. That is, results of this procedure will call for further examination when no examination is warranted in approximately 1 out of 100 dwelling units tested.

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BIAS AND PRECISION:

These bias and precision data were computed without substrate correction from samples with reported laboratory results less than 4.0 mg/cm^2 lead. There were 88 test locations with a laboratory reported result equal to or greater than 4.0 mg/cm^2 lead. Of these, none had XRF readings less than 1.0 mg/cm^2. These data are for illustrative purposes only. Substrate correction is not recommended for this XRF instrument. Bias and precision ranges are provided to show the variability found between machines of the same model. Units are in mg/cm^2.

MEASURED AT	SUBSTRATE	BIAS (mg/cm^2)	BIAS RANGE[P] (mg/cm^2)	PRECISION[*] (mg/cm^2)	PRECISION RANGE[P] (mg/cm^2)
0.0 mg/cm^2	Brick	0.0	(0.0, 0.0)	0.1	(0.1, 0.1)
	Concrete	0.0	(0.0, 0.0)	0.1	(0.1, 0.1)
	Drywall	0.0	(0.0, 0.0)	0.1	(0.1, 0.1)
	Metal	0.0	(-0.1, 0.1)	0.1	(0.1, 0.1)
	Plaster	0.0	(-0.1, 0.0)	0.1	(0.1, 0.1)
	Wood	0.0	(0.0, 0.0)	0.1	(<0.1, 0.1)
0.5 mg/cm^2	Brick	0.1	(0.0, 0.2)	0.3	(0.3, 0.3)
	Concrete	0.1	(0.0, 0.2)	0.3	(0.2, 0.3)
	Drywall	0.1	(0.0, 0.2)	0.3	(0.1, 0.3)
	Metal	0.1	(0.0, 0.3)	0.3	(0.3, 0.3)
	Plaster	0.0	(-0.1, 0.2)	0.3	(0.1, 0.3)
	Wood	0.1	(0.1, 0.2)	0.3	(0.3, 0.3)
1.0 mg/cm^2	Brick	0.2	(0.0, 0.4)	0.4	(0.4, 0.5)
	Concrete	0.2	(0.0, 0.4)	0.4	(0.3, 0.5)
	Drywall	0.2	(0.1, 0.4)	0.4	(0.2, 0.5)
	Metal	0.2	(0.0, 0.5)	0.4	(0.4, 0.5)
	Plaster	0.1	(-0.1, 0.3)	0.4	(0.1, 0.5)
	Wood	0.3	(0.1, 0.4)	0.4	(0.4, 0.5)
2.0 mg/cm^2	Brick	0.4	(0.0, 0.7)	0.6	(0.5, 0.6)
	Concrete	0.3	(0.0, 0.7)	0.5	(0.4, 0.6)
	Drywall	0.5	(0.3, 0.7)	0.5	(0.3, 0.6)
	Metal	0.4	(0.0, 0.8)	0.6	(0.5, 0.6)
	Plaster	0.2	(-0.3, 0.7)	0.5	(0.1, 0.6)
	Wood	0.5	(0.3, 0.7)	0.6	(0.5, 0.6)

[P]Ranges are provided to show the variability between machines of the same model.
[*]Precision at 1 standard deviation.

A document titled *Methodology for XRF Performance Characteristic Sheets* provides an explanation of the statistical methodology used to construct the data in these sheets, and provides empirical results from using the recommended inconclusive ranges or thresholds for specific XRF instruments. For a copy of this document call the National Lead Information Center Clearinghouse at 1-800-424-LEAD.

Table . Classification Results for the Pb Analyzer K-Shell 15-Second Readings (Uncorrected), Classified Using Inconclusive Ranges Reported in the XRF Performance Characteristic Sheet and Compared to Laboratory Results in mg/cm^2 Lead Classified Using the 1.0 mg/cm^2 Lead Federal Standard for Data Taken During the EPA/HUD Field Study and From Testing Archived Building Components in January 1995 and in September 1995.

SUBSTRATE	INCONCLUSIVE RANGE	FALSE POSITIVE RATE	FALSE NEGATIVE RATE	INCONCLUSIVE RATE
Brick	0.9 to 1.2	0.0% (0/74)	0.0% (0/25)	2.0% (2/99)
Concrete	0.9 to 1.2	1.0% (2/195)	11.1% (3/27)	1.4% (3/222)
Drywall	0.9 to 1.2	2.1% (3/142)	(0/0)	0.0% (0/142)
Metal	0.9 to 1.2	3.5% (7/199)	7.6% (5/66)	3.0% (8/265)
Plaster	0.9 to 1.1	1.6% (4/254)	2.5% (1/40)	0.3% (1/294)
Wood	0.9 to 1.3	3.9% (13/333)	4.7% (7/148)	4.6% (22/481)
TOTAL		2.4% (29/1197)	5.2% (16/306)	2.4% (36/1503)